

ISCR Masterworks Lecture Series

Presents:

**“Petascale Direct Numerical Simulation of
Turbulent Combustion”***Guest Speaker:***Dr. Jacqueline H. Chen***Combustion Research Facility
Sandia National Laboratory***Tuesday
May 12, 2009
2:00pm
Building 543, Auditorium****Abstract:**

The rapid growth in computing power has presented both opportunities and challenges for high-fidelity simulations of turbulent reacting flows. The advent of petascale supercomputers has made it possible to glean fundamental physical insight into fine-grained ‘turbulence-chemistry’ interactions in canonical laboratory-scale turbulent flames with direct numerical simulations (DNS). The unique benchmark DNS data are also used to develop and validate predictive models used to design future fuel-efficient combustors utilizing alternative fuels for transportation and power generation. Such simulations are costly, requiring several million cpu-hours on a petascale computer, over a billion grid points, and generating 100’s of terabytes of data. The turbulent combustion simulation enterprise involves collaborations with computer scientists in the performance monitoring and optimization of the software on petascale architectures, on automating workflow for providing runtime diagnostics, and on interactive data mining and visualization of time-varying multi-scale, multi-variate data. Aspects of these collaborations will be described along with combustion examples that illustrate the science role of DNS. Outstanding challenges with extracting salient information from terabytes of data, and strategies for mapping DNS solvers to multi-core petascale architectures will also be discussed.

About the Speaker:

Jacqueline H. Chen received her Bachelor’s degree from Ohio State University (1981), her Master’s degree in Mechanical Engineering from University of California at Berkeley (1982), and her Ph.D. in Mechanical Engineering from Stanford University (1989). She received the Sandia Employee Recognition Award for Technical Excellence in 1998, is an adjunct professor of Chemical Engineering at the University of Utah, and is a Distinguished Member of Technical Staff at Sandia since 2002. She is a Director of the Combustion Institute Board of Directors, a member of the Department of Energy’s Office of Advanced Scientific Computing Research Advisory Committee, and serves on several editorial boards of scientific journals: Co-editor of Proceedings of the Combustion Institute, Volumes 29 and 30, Editorial Advisory Boards of *Combustion and Flame*, *Progress in Energy and Combustion*, *Proceeding of the Combustion Institute*, and *Computational Science and Discovery*. She received the DOE INCITE Award in 2005, 2007 and 2008, the DOE Office of Science Leadership Computing Facility Award in 2006, and Early User 250Tflop and 1 Pflop awards at ORNL in 2008 and 2009. She has contributed to research in petascale simulations of turbulent combustion and topological methods for identification and tracking of scalar structure in turbulent reactive flow.

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